

"Broadening the Scope of Physics Education"
Spring Meeting of the Illinois Section of the AAPT
March 30-31, 2007
Western Illinois University, Macomb, Illinois
Friday, March 30, 2007

9:00 - 5:30 **Registration.** Currens foyer (in front of room 205). Please make out checks to "ISAAPT".

Please Recycle. When you leave the meeting to return home, please place your plastic name tag holder in the box which will be available in Currens 210. It will be used at the next meeting. Thanks.

10:00 - 12:00 **Workshop W1. "Observational Astronomy Simulations in the Instructional Laboratory"**, Dick Cooper, Gettysburg College, Currens 414.

10:30 - 12:00 **Workshop W2. "Robots in the College and High School Physics Classrooms, Part 2"**, James Rabchuk, Western Illinois University, Currens 420.

10:30 - 12:00 **Workshop W3. Cracker Barrel: "Recruiting Physics and Engineering Majors"**, Richard Martin, Illinois State University, Currens 204.

12:00 - 1:00 **Lunch** - on your own (Union Food Court or Lincoln Room)

Here is a list of those who are doing contributed presentations. Note that Sessions B, D, F and H are part of the Student Research Symposium.						
Friday, 1:00 - 2:45			Friday, 4:15 - 5:30			
1:00		B1. Bryan Hecox	4:15	C1. Patricia Sievert Take Fives	D1. Ryan Belfanz	
1:15		B2. Matthew Beckner	4:30		D2. Thomas Juskevics	
1:30		A1. Deborah Lojkutz and Ann Brandon	B3. Joseph Wiewel		4:45	D3. Andrew Johnson
1:45		A2. Brian Clark	B4. Patrick Szczypinski		5:00	D4. Keith Pelletier
2:00		A3. Dave Sykes	B5. Dennis Norton			
2:15		A4. Andrew Morrison	B6. Christopher Milby			
2:30			B7. Michael Morrisey			
Saturday, 8:15 - 9:30			Saturday, 10:45 - 12:00			
8:15		F1. Amy Erxleben	10:45	G1. Raymond Wilson G2. Brendan Noon Take Fives WITHITs	H1. Nic Chott	
8:30		F2. Thomas Traynor	11:00		H2. Tony Battaglia	
8:45		F3. Nathan Kidwell	11:15		H3. Isaac Goodin	
9:00		E1. Dave Cornell	F4. Tim Garvin		11:30	H4. Alison O'Connell
9:15		E2. Christopher Bush	F5. David Wischhusen		11:45	H5. Sawyer Campbell

1:30 - 2:30 **Session A (concurrent with Session B) - Currens 205** - Chair: TBA

1:30 - 1:45 - A1 - Active Learning

Laser Level High School Physics. *Deborah Lojkutz and Ann Brandon*, Joliet West High School, Joliet, IL 60435. Laser levels are now readily available at hardware stores, such as Menards, and their cost has dropped considerably over the past few years. This makes them an economic light source for high school optics demos and hands on lab activities. We will be sharing several labs and demos we have developed for our high school physics classes.

1:45 - 2:00 - A2 - Teaching Methods

Chaos, Complexity, and Teaching Physics to Liberal Arts Majors. *Brian K. Clark*, Illinois State University, Normal, IL 61790-4560. Most students at Illinois State University must take at least three science courses to complete their general education requirements. One of the many courses that students can choose to meet the requirement is Chaos and Complexity. The content of the course can be instructor specific, but generally includes topics from non-linear dynamics, chaos, fractals, cellular automata, control, and synchronization. My section is designed to place a heavy emphasis on students learning from and producing graphs instead of reliance on equations. In this presentation, I compare student test performance on graph related questions to more traditional equation related questions.

2:00 - 2:15 - A3 - Teaching Methods

Just-In-Time-Teaching....With Time to Spare. *Dave Sykes*, Lincoln Land Community College, Springfield, IL 62794-9256. Having students be prepared for class has always been a challenge for teachers. In this presentation a method that entices students to be prepared for class will be described, along with a possible use for the extra class time that is generated by the method.

2:15 - 2:30 - A4 - Active Learning

Physics Lab Myths. *Andrew Morrison*, Illinois Wesleyan University, Bloomington, IL 61701. As a way of introducing students to the general physics laboratory, I present them with a short true-false quiz at the first laboratory meeting. The quiz has a series of statements about the student's belief about a physics laboratory. The students work in groups to come to a consensus and justify their opinions. The students decide (similar to the *Mythbusters* television show) whether each statement is confirmed (true), plausible, or busted (false). We discuss each statement as a class, and I share my opinions. In this way, I introduce my ideas to the students on what the lab experience should be about.

1:00 - 2:30 **Session B (concurrent with Session A) - Currens 202** - Chair: Paul Wang, Bradley University

1:00 - 1:15 - B1 - Student Research Symposium

Effects of Annealing Cool-Down Rate on the Sensitivity and Linearity of Magnetoelastic Transducer Response in 4340 High-Alloy Steel. *Bryan G. Hecox and Mark S. Boley*, Dept. of Physics, Western Illinois University, Macomb, IL 61455. We have investigated the change in the linearity and the sensitivity of the magnetoelastic torque transducer response as the annealing cool-down rate is changed in 4340 high-alloy steel. Three separate steel 1-inch diameter solid shafts underwent a common hardening process conducted in a helium atmosphere at 843°C, an oil quench to room temperature, then a follow-up five hour annealing process also at 843°C. Subsequently, the three samples were cooled down at rates of 10°C, 15°C, and 20°C, respectively. Prior and subsequent to heat treatment, the external field signals were mapped over the magnetically polarized regions both with and without applied torque load, resulting in applied shear stress up to 3500 pounds / square inch (psi). The faster annealing cool-down rate increased the transducer response (sensitivity) and the Gaussian field map shape and height across the torque-loaded sample by the most while maintaining consistent linearity in all samples.

1:15 - 1:30 - B2 - Student Research Symposium

The Effect of Transducer Diameter on Magnetoelastic Sensitivity and Polarized Domain Wall Profiles in ESR420 Steel. *Matthew W. Beckner and Mark S. Boley*, Department of Physics, Western Illinois University, Macomb, IL 61455. In earlier research, we have found that the 13% chromium stainless steel, ESR420, is an excellent candidate for torque sensing applications in the standard 3/4 inch (18 mm) hollow shaft configuration, while our present samples ranged from 18 mm down to 5 mm. The technique of sequential magnetic force microscopy (MFM) scans was used to directly measure the width and height of the center domain wall between the two circumferentially magnetically polarized regions in each sample and correlate it to sensor diameter and axial coercivity. The sensory section of each shaft was also mapped with a Gaussmeter to obtain the difference between magnetic signal with and without torque load and this correlated with domain wall height. Additionally, a direct correlation was observed between the domain wall region's area (its product of width and height) found by both methods and the torque load sensitivities at all sample diameters.

1:30 - 1:45 - B3 - Student Research Symposium

Effect of Low Nickel Dopant on Torque Transducer Response Function in High-Chromium Content ESR Stainless Tools Steels. *Joseph L. Wiewel and Mark S. Boley*, Department of Physics, Western Illinois University, Macomb, IL 61455. The change in magnetoelastic torque transducer response was investigated as a low nickel content (up to 0.20%) was alloyed into an ESR (Electro-Slag-Refining) stainless tool steel with a high chromium content of around 13.0%. Two separate hollow steel 3/4-inch diameter shafts were prepared from ESR416 and ESR420 steel, the first having no nickel content and the second having 0.20% nickel content. However, the ESR416 also contains 1.25% manganese and the ESR420 only 1.00% manganese. To verify that the change in magnetoelastic response occurred as a result of the increase in nickel rather than the decrease in manganese, the same tests were also performed on ESR410, whose composition mirrors ESR416 except the manganese content is 1.00%. It was found that the effect of the low nickel dopant was to improve torque transducer sensitivity and linearity, while the change in manganese content had virtually no effect.

1:45 - 2:00 - B4 - Student Research Symposium

The Ambient Temperature Dependence of Magnetoelastic Response Function in Steel Alloy Torque Transducers. *Patrick R. Szczypinski and Mark S. Boley*, Dept. of Physics, Western Illinois University, Macomb, IL 61455. Changes in magnetoelastic response function with ambient temperature of three commonly applied steel torque transducers, PMT-15, Kapstar, and ESR-420 were investigated. Our studies over easily attainable ambient temperature ranges in our laboratory from 20°C to 56°C clearly show that in these three samples there is little or no gain or loss to magnetoelastic response to applied torque (less than 0.1 mG/N-m°C in either direction), but rather that magnetic background signal in these transducers has a very definite positive slope with temperature of around 10 mG/°C. This is most likely due to the increase of magnetic randomness with thermal excitation in the pre-conditioned polarized sensory regions of the transducer. Our laboratory tests were performed with the sensor torqued and untorqued both on the temperature upstroke and downstroke. Thus, appropriately programming the transducer's sensory electronics to include the slope of magnetic background signal with temperature, will ensure transducer reliability.

2:00 - 2:15 - B5 - Student Research Symposium

Processing Gallium Antimonide and Indium Arsenide for Enhancement of MWIR and LWIR LEDs. *Dennis T. Norton and Mark S. Boley*, Dept. of Physics, Western Illinois University, Macomb, IL 61455. Novel materials made from GaSb and InAs play a vital role in the development of mid-wave infrared (MWIR) and long-wave infrared (LWIR) optoelectronic devices such as light-emitting diodes (LEDs). A significant barrier to achieving high output power from LEDs arises from total internal reflection at the substrate-air interface, but an optimal design involving angled side-walls allows for a 25% increase in power output due to light emitted horizontally being re-directed to the surface of the LED. New etches have been developed which favor this light re-direction. Over 160 etched samples have been characterized using a Leitz Ergolux Microscope, and atomic force microscopy (AFM) has been used to obtain sample heights and etching depths across the active regions and the angle of the etched sidewall. To date, a correlation between the angle of the sidewall and the ratio of HCl:H₂O used in the etching recipe has been determined.

2:15 - 2:30 - B6 - Student Research Symposium

The Comparison of Solid and Hollow Magnetoelastic Torque Transducer Response Function in Two High-Chromium Alloys. *Christopher L. Milby and Mark S. Boley*, Dept. of Physics, Western Illinois University, Macomb, IL 61455. Recent investigations of torque transducer response function (ambient field signal versus applied torque load or applied shear stress) have been conducted in two high-chromium content (13%) stainless steel alloys, with code names 13Cr8Ni (also contains 8% nickel) and ESR410 (contains 0% nickel), in both hollow and solid shaft configuration. An understanding of both is needed for applications with differing yield strength and hardness requirements. The field map height and the torque transducer response function were reduced following heat treatment in both samples, most likely due to the increased mechanical hardness (essential in real applications). However, our studies showed the hollow shaft configuration to have a far superior degree of polarization in the sensory region and to exhibit an enhanced sensitivity over the solid shaft configuration in both steel types. This is most likely due to more efficient provision of closed circumferential geometry for the field lines.

2:30 - 2:45 - B7 - Student Research Symposium

Cellular Automaton of Mall Walkers. *Michael Morrissey and Brian Clark*, Illinois State University, Normal, IL 61761. Mall walkers attempt to maintain a constant speed while walking through a mall. However, mall shoppers are constantly getting in their way. We made observations at a local mall that includes speed and group size of mall shoppers and developed a computer program to model the mall walker's trip through the mall. The model is a Monte Carlo simulation and is designed to determine how well a mall walker can maintain the desired speed.

2:45 - 3:00 - Break - Currens 210

3:00 - 3:05	Welcome - Currens 205 - CAS Dean Levi or Physics Chair Incera
3:05 - 4:00	<p data-bbox="399 117 1398 184" style="text-align: center;"><i>"Using the Science Writing Heuristic to Improve Students' Understanding of Topics in General Chemistry"</i></p> <p data-bbox="659 216 1135 304" style="text-align: center;">Dr. Thomas J. Greenbowe Chemical Education, Iowa State University Currens 205</p> <p data-bbox="310 338 1481 480">A series of studies over a six-year period compared the performance of general chemistry students using the Science Writing Heuristic (SWH) to the performance of students using a traditional format on lecture exams and on laboratory practical exams. The SWH approach incorporates active learning, guided-inquiry, group work, and a different structure for the laboratory notebook in a format that guides students through a laboratory experiment.</p> <p data-bbox="310 512 1481 625">In the SWH approach, students must pose questions to investigate, make a claim (inference) about what was learned through the laboratory experiment and provide experimental evidence to support that claim. Then, through group discussion and reflective writing, students continue to negotiate meaning from the experiment they conducted.</p> <p data-bbox="310 657 1481 714">Subjects in these studies were students enrolled in various first and second semester general chemistry courses for science and engineering majors.</p> <p data-bbox="310 745 1481 831">The American Chemical Society (ACS) national standardized California Chemistry Diagnostic Test, the ACS First Semester and Second General Chemistry Exam (depending upon the year of the study), and the instructor-made final exam were used as pre-tests and post-tests.</p> <p data-bbox="310 863 1481 949">Chemistry graduate students serving as teaching assistants (TAs) were given a workshop on how to teach using the traditional approach and the SWH inquiry approach. TAs taught the lab sections either using the SWH approach or the traditional approach.</p> <p data-bbox="310 980 1481 1094">In each of the studies, students using the SWH format out-performed students using the traditional format on chemistry exams administered in the lecture component of the course and on most laboratory practical exam tasks. Female students using the SWH format out-performed female students using the traditional format.</p>

4:00 - 4:15 - Break - Currens 210

4:15 - 5:00 Session C (concurrent with parts of Session D) - Currens 205 - Chair: Brian Davies, WIU

4:15 - 4:30 - C1 - Demonstrations

Ten Demos To Do With a Green Laser Pointer. *Patricia Sievert*, Northern Illinois University, DeKalb, IL 60115. A green laser pointer can now be purchased for less than \$40. The high visibility of the green laser pointer lends itself to spontaneous demonstrations without the need for totally blacking out the classroom. I'll share demonstrations of interference, diffraction, color effects, and total internal reflection.

4:30 - 4:50 - Take Fives - Currens 205

1. *David Horner*, Standing Waves: A "Design Your Own Experiment" Activity
2. *Deborah Lojkutz*, "Modern Physics Fair at Fermilab"
3. *Patricia Sievert*, "Networking Announcements and Plug for Programs"
4. *Cliff Parker*, "A Tuning Fork Question"
Announcements

4:15 - 5:30 Session D (concurrent with Session C) - Currens 202 - Chair: David Renneke, Augustana College

4:15 - 4:30 - D1 - Student Research Symposium

Cellular Automaton Based Investigation of the Transition from Non-flocking to Flocking Behavior. *Ryan M. Balfanz and Brian K. Clark*, Illinois State University, Normal, IL 61790-4560. A cellular automaton is a discrete model consisting of a number of elements arranged in a grid. This grid may be thought of as a small universe containing a set of laws or rules assigned by the experimenter. Very complicated behavior can arise from a small set of seemingly simple rules. While flocking of birds is a well understood behavior, the transition from non-flocking to flocking, however, is not well understood. By creating a miniature cellular automaton universe with certain rules, we hope to deduce the rules that cause the transition from non-flocking to flocking behavior. Using a Fortran based computer program various rules will be modeled and included in the system.

4:30 - 4:45 - D2 - Student Research Symposium

Simulating DNA Mutation with Statistical Modeling. *Tom Juskevics and Brian K. Clark*, Illinois State University, Normal, IL 61761. Living organisms need to be able to change based on their environment in order to survive. This process of adapting to the environment is fueled by mutation. If one can understand how mutation works then one can gain a glimpse of how organisms adapt to their environment. The goal of this project is to compare experimentally measured characteristics of a set of genes in the human genome to predictions from a cellular automaton model based on reported mutation rates. The automaton model assumes there is a reservoir of nucleotides whose composition is user defined. A Monte Carlo approach is used to select which nucleotide in a gene is subject to a mutation. The program then picks a nucleotide from the reservoir to replace the nucleotide that was selected for mutation.

4:45 - 5:00 - D3 - Student Research Symposium

A One-Dimensional Ponderomotive Trap. *Andrew Johnson and James Rabchuk*, Western Illinois University, Macomb, IL 61455. A ponderomotive trap is one that uses a time and space-dependent force to keep the object near the equilibrium point. An important application of these traps is the RF Paul ion trap. We have studied a one dimensional mechanical ponderomotive trap. Our trap was configured so that a bead was free to move along a circular ring that was rotated around the horizontal axis at specified frequencies. We investigated the stability of the trap using numerical methods under ideal conditions and including friction. For small angles the motion can be described by the solution to Mathieu's equations, and was found to be always unstable. Allowing for deviations from the small angle approximation resulted in greater trap stability. The introduction of friction was shown to uniformly increase the stability of the trap for all initial values of the angle. These results are compared with those for the RF Paul trap.

5:00 - 5:15 - D4 - Student Research Symposium

Studies of RF Heating in Miniature Ion Traps. *Keith Pelletier and James Rabchuk*, Western Illinois University, Macomb, IL 61455. RF Paul ion traps have been an important tool in trapped ion quantum information processing. Arrays of ion traps have been proposed as the basis for a quantum computer. It will be important to control ion heating as the traps are miniaturized to create these arrays. Experiments performed recently point to the existence of fluctuating patch potentials on the electrode surfaces as the main source of anomalous ion heating. We will present results from numerical and analytical studies that identify and characterize the heating processes of ions in miniature end-cap traps as functions of trap size. We will also show that there should be an easily observable difference between heating from very small patches and coherent noise from the electrode. In particular, very small patches produce a heating term that is dipole-like and shows a dramatic z^{-6} dependence on the electrode separation. This should be easily detectable by experiment.

5:15 - 6:00 - Lab Tours or Free Time for hotel check-in or move cars to closer lots.

6:00 - 6:30 - Social time – Lincoln room in the University Union (with cash bar)

6:30 - 7:30 - Banquet - Lincoln Room in the University Union. Presentation of the *Outstanding High School Physics Teacher Award* to Charles Adamovic, Lyons Township High School, Lagrange.

7:30 - 8:30	<p style="text-align: center;">"What Do Physics Instruction and Loss of Memory Have in Common?"</p> <p style="text-align: center;">Dr. John S. Rigden Physics Department, Washington University, St. Louis Lincoln Room in the University Union</p>
-------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Saturday, March 31, 2007

7:15 - 8:15 - ISAAPT Council meeting - Presiding: Troy Gobble, President. Currens 202.

8:00 - 10:00 - Registration. Currens foyer. Please make out your checks to "ISAAPT".

9:00 - 9:30 Session E (concurrent with Session F) - Currens 205 - Chair: TBA

9:00 - 9:15 - E1 - Active Learning

Witnessing a Cover-up: Imaging a Stellar Occultation by an Asteroid. *David A. Cornell, Thomas H. Fuller, and Catherine A. Hooper*, Principia College, Elsah, IL 62028. On January 26, 2007, asteroid 372 Palma occulted the star 32 Lyncis in what the Royal Astronomical Society of Canada dubbed the "occultation of the year" for North America. Although the path of the asteroid's shadow was predicted to miss our location by about 50 miles, we went to the telescope at 4:30 AM to attempt to observe it anyway, hoping to catch the shadow of one of the asteroid's satellites. In fact, we were rewarded by observing six seconds of occultation by the asteroid itself. Simple ray optics portray the results of two dozen coordinated occultation measurements, which define the shadow shape parameters. The presentation shares the preparation for the event, imaging scheme, analysis of the image, and team results for this astronomical cover-up.

9:15 - 9:30 - E2 - Active Learning

Design and Applications of a Solar Racing Vehicle. *Christopher Bush*, Brian K. Clark, Daniel Holland, David T. Marx. Illinois State University, Department of Physics, Campus Box 4560, Normal, IL 61761. The Illinois State University Solar Race Car team built and raced a solar powered vehicle from Austin, TX to Calgary, AB in July of 2005. Aside from the shell and suspension, which were part of an old car, everything was redesigned to work our equipment to bring it up to date with regulations. Although the end goal was to build a race vehicle, the project provided valuable experience for the students involved by allowing them to apply the physics learned in the classroom to a real-life experience. As well, the project proved to be an excellent platform for community outreach. A solar race vehicle is an excellent project to engage students and show them the everyday uses of physics.

8:15 - 9:30 Session F (concurrent with Session E) - Currens 202 - Chair: TBA

8:15 - 8:30 - F1 - Student Research Symposium

Dynamics of the Chaotic Waterwheel. *Amy Erxleben*, Illinois State University, Normal, IL 61761. The chaotic waterwheel is a simple mechanical system that has been used for years as a basic example of the type of chaotic system obeying the Lorenz equations. The tilted wheel is powered by water entering directly at the top, and the water leaks from the wheel at a known rate. The water in the cylindrical cells can either work to speed the wheel up or slow its motion down, depending on its location. If friction is added to this system, the wheel can become chaotic and its motion at any point in time cannot be predicted. Our research group has constructed such a system and is now in the process of gathering and analyzing data. Among the things we are looking for are differences between the computer predictions of the idealized wheel and the behavior of the experimental wheel. Other aspects of the wheel that will be described are the processes used to determine the vital parameters governing the system and our ability to use them to manipulate the wheel's behavior.

8:30 - 8:45 - F2 - Student Research Symposium

Construction of an Electronic Speckle Pattern Interferometer. *Thomas Traynor*, Illinois Wesleyan University, Bloomington, IL 61701. Electronic speckle pattern interferometry is used to look at the operating deflection shapes of vibrating objects. An effort has been made to make this technology more accessible by using lower cost components and perfecting current methodology. It has been shown that by using an inexpensive firewire camera and a 100mW laser that interference patterns of a center mounted circular steel plate can be observed through a range of drive amplitudes and frequencies. The images obtained have been improved using an image averaging technique implemented through LabView. Image quality has also been improved by implementing a piezo driven mirror that was simply constructed at IWU. Also discussed will be other techniques for improving image quality.

8:45 - 9:00 - F3 - Student Research Symposium

The Interaction of Intensity Modulated Laser Light With Complex Media. *Nathan Kidwell*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61791. In contrast to the interaction of x-rays with human flesh that is characterized by the beam like propagation, laser light is constantly redirected in all directions and is therefore much more difficult to be used to detect hidden objects inside a turbid medium in a trans-illumination geometry. It turns out, however, if the intensity of the laser light is periodic modulated in time the high frequency component of the laser light propagates nearly light a straight beam through the material, making this type of light suited for transmission based imaging of highly scattering materials. I will also outline another imaging scheme based on decomposition into a set of

basis states.

9:00 - 9:15 - F4 - Student Research Symposium

Pencil Beam Propagation and Application in Image Reconstruction. *Tim Garvin*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61761. We propose an iterative scheme to compute quasi-analytically the laser irradiance transmitted through a turbid media illuminated by high frequency intensity modulated light. We compare the spatial distribution of the transmitted signal obtained from the iterative calculations with that obtained from random walk simulations and the traditional diffusion theory. In the regime where the diffusion theory breaks down for a highly modulated source only the ballistic and quasi-ballistic photons survive. This regime could become accessible for interesting imaging applications as the beam width of the ac-signal of the transmitted light decreases with increasing frequency.

9:15 - 9:30 - F5 - Student Research Symposium

Interference in the Pair Creation Process of a Model System. *David Wischhusen*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61791. Two particles such as electrons when created at two different locations in space should not interfere with each other as each electron is created with its antiparticle partner, the positron. As the corresponding positron could be measured in principle the two electrons are distinguishable. If, however, the two birth places are close to each other such that at each location only half of the probability density associated with a single electron is created then the two probability portions describing the same electron should interfere with each other. I am proposing a set of computer simulations based on quantum field theory to explore the amount of interfere during the strong field induced electron-positron pair creation process from vacuum. We plan to accompany with these quantum field studies with classical mechanical ensemble and also quantum mechanical wave function simulations.

9:30 - 9:45 - Break - Currens 210

9:45 - 10:30	<p style="text-align: center;"><i>"Cannonballs or Baby's Bowls: How Context and Gender affect Physics Tests"</i></p> <p style="text-align: center;">Dr. Laura E. McCullough Department of Physics, University of Wisconsin-Stout Currens 205</p> <p>As physics teachers, we like to think that physics is physics, no matter what context we see it in. A study of how the context of a physics question affects student response suggests that students don't see it the same way. Changing a question from a stereotypically male context (a cannonball fired from a cliff) to a stereotypically female context (a baby hits her bowl off her tray) affects student answers. In this talk I will focus on the effects of context and gender on student answers to physics questions.</p>
---------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

10:30 - 10:45 - Break - Currens 210

11:00 - 11:45 Session G (concurrent with Session H) - Currens 205 - Chair: TBA

11:00 - 11:15 - G1 - Active Learning

Missing from Your Physics Curriculum? *Raymond G. Wilson*, Illinois Wesleyan University, Bloomington, IL 61702. For 27 years Illinois Wesleyan University has been providing its students with an important course about which some students have remarked, "This should be required of everyone!" They are speaking of my course about the 1st nuclear war and world nuclear armaments. Is a course like this missing from your curriculum? The topic seems sufficiently important. After all, these nuclear problems led to the creation in 1945 of a new "journal", The Bulletin of the Atomic Scientists, endorsed by many Nobel Laureates, including Hans Bethe, James Franck, Andrei Sakharov, Linus Pauling, Albert Einstein, and also Robert Oppenheimer and Leo Szilard. These nuclear problems remain largely unsolved; some have become more complex. Is your physics department helping to teach the next generations of politicians and decision-makers, citizens, to fully understand the nature of nuclear war and the importance of a solution to this problem? If you don't, who will?

11:15 - 11:30 - G2 - Teaching Methods

Ten Ways to Engage Your Students with Innovative Technology. *Brendan Noon*, Argo Community High School, Summit, IL 60501. Whether you moodle, google, or doodle, technology is an essential part of developing engaging lessons. This presentation demonstrates a variety of innovative methods that are being developed into an online physics curriculum (www.sciencewithmrnoon.com). Some of the lessons that will be highlighted during this presentation include creating web based presentations, Flash animations, video webcasting, interactive quizzes, live web conferencing, virtual simulations, online discussions, webquests, and classroom response systems (clickers).

11:30 - 11:45 - Take Fives - Currens 210

1. *Bill Hogan*, "Taking Lenz's Law Seriously"
WITHITs, Announcements
-

10:45 - 12:00 Session H (concurrent with Session G) - Currens 202 - Chair: Pengqian Wang, WIU

10:45 - 11:00 - H1 - Student Research Symposium

Phase Space Density Approach to the Creation of Matter from Vacuum. *Nic Chott*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61761. We examine the creation of electron-positron pairs in a very strong force-field. Using numerical solutions to quantum field theory we calculate the spatial and momentum probability distributions for the created particles. A comparison with classical mechanical phase space calculations suggests that despite the fully relativistic and quantum mechanical nature of the matter creation process, most aspects can be reproduced accurately in terms of classical mechanics.

11:00 - 11:15 - H2 - Student Research Symposium

Extrapolation Based Imaging in Turbid Media. *Tony Battaglia*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61790-4560. Have you ever wondered why a picture watched through a glass of milk looks completely blurred? If you watch the same image through two or even three glasses of milk, the images obviously get even worse. I will discuss a simple computer algorithm that requires as input the three images obtained and based on a simple extrapolation scheme is capable of predicting how the image would look like if watched through no glass of milk. This extrapolation based imaging scheme has therefore the potential to improve the resolution of the otherwise blurred images by using and inverting the trend established by the three images. I will present a simple theoretical model to show the feasibility of such an approach and also a first set of experimental data serving as a proof of principle for the proposed technique.

11:15 - 11:30 - H3 - Student Research Symposium

First Experiment of Decomposition Based Imaging in Milk. *Isaac Goodin*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61790-4560. We have injected a He-Ne laser beam onto a rotating mirror system in order to illuminate uniformly a 20 centimeter wide aquarium that is filled with a milk water solution of various concentrations. We have inserted a metallic rod into the tank and using a fiber optical detector we scan the transmitted light pattern as a function of the transverse direction. For a rod location close to the input surface of the tank the impact of the rod on the transmitted light pattern is practically negligible. As we moved to rod toward the back surface of the aquarium a shadow develops. The precise function form of this shadow can be used to find out where the rod was placed. The long term goal of my research is to use this decomposition based imaging technique to predict the spatial structure of an arbitrarily shaped reflector or absorber inside the tank.

11:30 - 11:45 - H4 - Student Research Symposium

Monte-Carlo Simulation of Non-diffusive Behavior of Light Scattering. *Alison O'Connell*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61761. We discuss the impact of large-angle scattering events in highly forward scattering media on the spatial distribution of the diffusively reflected light. We show that, even for highly forward scattering media such as biological materials, the reflected light near the incident beam axis is strongly dependent on the very small number of large-angle scattering events. Reliable modeling of near-axis reflection thus requires accurate knowledge of the scattering phase function's behavior at large angles.

11:45 - 12:00 - H5 - Student Research Symposium

Light Distribution Along the Optical Axis in Milk Water Mixtures. *Sawyer Campbell*, Intense Laser Physics Theory Unit, Illinois State University, Normal, IL 61761. We inject an angularly collimated laser beam into a scattering medium of a non-dairy creamer-water solution and examine the distribution of the scattered light along the optical axis as a function of the source-detector spacing. The experimental and simulated data obtained from a Monte Carlo simulation suggest four regimes characterizing the transition from un-scattered to diffusive light. We compare the data also with theoretical predictions based on a first-order scattering theory for regions close to the source, and with diffusion-like theories for larger source-detector spacings. We demonstrate the impact of the measurement process and the unavoidable absorption of photons by the detection fiber on the light distribution inside the medium. We show that the range of validity of these theories can depend on the experimental parameters such as the diameter and acceptance angle of the detection fiber.

11:45 - 12:45 - Lunch - *It must be ordered with Registration.* **Currens 210 or 205**

1:00 Meeting of the Program Committee for the Fall 2007 meeting in Springfield